Enhancing Kinetic Energy to Heat Conversion in Kinetic Energy Warheads via Use of Brittle Metals

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Introduction

Although kinetic energy impactors are already quite useful for attacking underground bunkers, kinetic energy impactors cause little damage at the surface of the Earth. While these devices are suitable for most purposes, alternative materials may be used in order to enable hypersonic kinetic energy warheads to be used for a different application.

Abstract

When devastation was unleashed on Tunguska in 1908, it was the result of the conversion of the kinetic energy of an asteroid or comet into thermal energy. Profoundly, little of the object made it to the ground. The damaged caused was purely the result of heat and an overpressure wave generated by the interaction of the object and the atmosphere. Physics simulators tell us that iron (the material of which most asteroids are composed) should not have so readily disintegrated but should have struck the surface of the Earth. When such objects survive to strike the surface of the Earth, an incredible amount of particulates are projected into the atmosphere and this can lead to the 'nuclear winter' effect.

Why did the Tunguska and, more recently, the Chelyabinsk objects disintegrate whereas other meteorites survive to make impact? Is this a question of size, alone, or is there some other factor at play? I propose that asteroids may have variable degrees of oxidation and the extent to which an asteroid is "rusty" dictates its behavior once it strikes the atmosphere. Rusty iron is very brittle, which actually makes it ideal for kinetic energy to heat conversion. The more rapid this conversion, the more pronounced the overpressure wave. The more brittle the metal, the more scattering can occur and the wider an area may be affected.

Therefore, if one wishes to create a purpose-built weapon which is designed to have an incendiary effect upon the surface of the Earth, one should investigate the possibility of utilizing rusty iron slugs with a thin aluminium coating calibrated in order to result in the disintegration of the slug at a particular altitude. This coating should be, naturally, thicker in the areas in which the highest temperatures from atmospheric friction can be expected with the exception of a small divot at the center of the nose.

By causing the failure of the aluminium coating to occur at the exact center, extreme heat would be forced through the core of the slug and would cause it to blow apart, enhancing the scattering effect and rapidly expanding the physical area over which friction may occur. This could be expected to produce immense heat and pressure potentially exceeding the theoretical maximum rate of overpressure achievable by explosives. The only limit upon

the amount of energy which may be introduced is the maximum attainable velocity of the kinetic warhead and the ability of the coating to withstand atmospheric friction for long enough to allow the slug to reach the target altitude.

Novel propulsive technologies such as photo-magnetic propulsion could be expected to make it practical for far-greater speeds to be achieved than the current record of Mach 11 for a kinetic energy impactor. Although ensuring accuracy would be challenging at such high speeds, it should be possible using photo-magnetic propulsion to accelerate a 2000kg impactor to 1% of the speed of light over a period of approximately five days. At such a velocity, an impactor capable of a programmed disintegration and composed of brittle materials would unleash sufficient energy to destroy an area approximately 3400km in diameter without the use of nuclear or thermonuclear detonations. This would enable the destruction of all life and structures at the surface of the Earth on a continental scale without causing too great an amount of particulates to be projected into the atmosphere and with but a single warhead moving at too great of a velocity to possibly be detected or stopped.

Conclusion

In such a regime, yield could be adjusted by adjusting velocity. In order to have sufficient room for acceleration, the orbit of the moon could be used as a staging area for these weapons. For guidance, it would be necessary to establish an ultra-high-altitude GPS system which is based around the moon rather than the Earth so that objects between the moon and Earth can benefit from precision guidance even at altitudes far higher than the orbital altitude of the existing GPS system. The weapons would require a portable energy source such as a battery. Concentric rings of high-density energy storage batteries could be used to enable a comparatively heavy overall package to detach sets of batteries after they are exhausted in order to increase the efficiency of ongoing acceleration. Judicious use of rapidly pulsed acceleration/deceleration can be used to reduce integument heating (ibid.) as can assurance of unidirectionality of the flow of acoustic energy (ibid.) and acoustic energy dampening at the rear of the integument of the warhead (ibid.). If the kinetic energy warhead is like a chisel, pulsed acceleration/deceleration is like the hammer tapping on the chisel to enable it to cut through the difficult-to-penetrate material.

Although the original intent was the defection of near-Earth objects, clearly, the PoMP propulsive technology is clearly highly weaponizable and may ultimately result in the creation of weapons with more energetic potential than nuclear weapons.